THURSDAY, JUNE 18, 1891.

EGYPTIAN IRRIGATION.

THE "Note" on the above subject by Sir Colin Moncrieff, which we publish this week, will prove pleasant reading to all who have the welfare of Egypt at heart. To those who have known that country intimately in the past, the brief record of progress in irrigation since the British occupation will recall the horrors of the *corvée*, and the torturing of the wretched peasantry by tyrannical farmers of the taxes; and to engineers the record will imply, not only that all those atrocities have been abolished, but further that some of the most difficult and important engineering problems of recent times have been successfully solved by Sir Colin Moncrieff and the able staff under his control. Nothing is exaggerated, but we have in the "Note" a plain and modest statement of the quiet and unostentatious execution of works the mere discussion of the difficulties of which had occupied the time of the predecessors of Sir Colin for the previous quarter of a century without anything useful resulting.

It will be only necessary to refer to one or two matters to establish this proposition. In paragraph 10, Sir Colin announces that the Barrage has been completed, and placed in a condition to fulfil its original purpose, for the sum of about £460,000. Contrast this with the published statement of M. Linant, a former engineer-in-chief of the Egyptian Government, who, in 1872, expressed a doubt whether it would not cost more to repair the existing Barrage than to build an entirely new one, and further says: "If, at the time when the Barrage was commenced, steam-engines had been what they are to-day, one would certainly have advised Mehemet Ali to abandon his project of a Barrage for the establishment of pumping-machinery." Even at that time, M. Linant thought it was not too late to consider whether it would not be better to abandon the idea of repairing the Barrage; and to assist in the determination of the question he submitted an estimate of the cost of pumping, amounting to £465,000 per annum, which, he thought, the cultivators could well afford to pay.

We have already stated that Sir Colin Moncrieff has effected the same result by a single expenditure of £460,000 instead of by an annually recurring one of £465,000. By means of the completed Barrage the whole summer supply of the Nile is thrown on to the lands, so obviously there is no work for pumps, and the vast cost of the same is saved to the country. Although national feeling runs high in France, we cannot but think that French engineers will rejoice that the world-renowned Barrage of the Nile, the design of which by M. Mongel was approved of by the Council of the Ponts et Chaussées in 1842, and carried into execution during the ensuing ten years, has at last, after thirty years' practical inutility and failure, been finally completed by their worthy compeers and successors in Egypt—the British engineers—whose experience, gained in the great irrigation works of our Indian Empire, has been as zealously utilized in securing the success of a great French work as it would have been in carrying out a new one of their own design.

One other matter in Sir Colin Moncrieff's "Note" may be referred to—namely, the drainage recently effected No doubt, the fact enforced upon Indian engineers by. numberless experiences—that high-level perennial irrigation must be accompanied by drainage works if soil and people are to remain in a healthy condition—was not well known to the French projectors of summer irrigation works in Egypt; and, as a consequence, whereas magnificent canals carrying 5000 cubic feet and upwards per second were constructed, no corresponding means were provided for draining the superfluous and often saline water off the lands. Sir Colin tells us that the mileage of the drains at present is not less than 1500. When we consider that, in addition to these vast works of improved irrigation and drainage, a steady reclamation of marsh-land has been going on, we have reason as a nation to be proud of the good work which our countrymen have carried on in Egypt; as, whatever may happen in the future, the fact of the British occupation will, from its successful applications of science, be indelibly stamped upon the face of the country for all time, and its memory will for other reasons live honourably in the traditions of the emancipated and much-enduring fellaheen.

PHYSIOLOGICAL PSYCHOLOGY.

Leitfaden der physiologischen Psychologie. In 14 Vorlesungen. Von Dr. Th. Ziehen, Docent in Jena. (Jena: Gustav Fischer, 1891.)

THIS little volume will be welcome to a good many students of psychology, both in Germany and beyond. Anyone who has had to look up the newer researches in experimental psychology in Germany knows the serious difficulty of gaining easy access to them. They are scattered over a whole heterogeneous mass of serial and other publications. Now we have to look into an avowedly psychological journal or brochure, but more frequently still into physiological works, and not infrequently into journals for psychiatry. The explanation is obvious. Psychology, in passing into the objective and experimental phase, is broadening its base to an almost perplexing extent, and is encroaching more especially on the domain of physiology. Hence the need of a volume like the present work, which aims at giving the beginner a conspectus of the psychological field. We want such a book badly in English, the only available one, that of Prof. Ladd, being at once incomplete on certain sides, and in part too metaphysical. Meantime we can recommend Dr. Ziehen's "Vorlesungen" as exceedingly well adapted to give the student a clear idea of the scope and the methods of the new science of physiological psychology.

Dr. Ziehen marks off physiological from what he calls transcendental psychology by the differentia that it deals with psychical processes as attached to cerebral functions. Psychophysic, the branch of investigation opened up by Weber and Fechner, he includes under physiological psychology as that part which aims at exact measurement. This seems to be a satisfactory way of mapping out the ground. The standpoint of the physiological psychologist is indicated in the assumption that every psychical process must be thought of as having a concomitant physiological process. This, too, though it would exclude such a "physiological psychology" as that of Ladd, seems a reasonable way of viewing the matter. Further, the author proceeds to set forth the typical form of psycho-physical process as reflex, and he considers that every known development of the psychical phase must be capable of being viewed as an incident in such a reflex process. Here Dr. Ziehen meets the real difficulty in psychology, and, as we see, meets it boldly. From the physiological point of view we are bound to take the reflex as our starting-point, and to view the most intricate plexus of cerebral processes as merely an expansion of the intermediate central stage of this reflex. But can the same mode of treatment be applied to the intricate interweavings which constitute our mental life? As mere events in time, synchronizing with neural events, they appear to be susceptible of being thus regarded, and this, as the author rightly contends, is precisely the way in which the physiological psychologist has to conceive of psychical phenomena.

Starting, then, with the reflex, of which the writer gives an admirable account by way of introduction, he proceeds to deal with the psychical process in its three successive stages, viz. sensation, answering to the afferent or sensory section of the nervous process; ideation, or, as he puts it, association, answering to the expanded form of the central section; and action, answering to the efferent or motor section. The account of sensation is fairly full, and up to date. Perhaps the treatment of the relation of stimulus to sensation (Weber's law) is proportionately too long. The discussion of the interpretation of the facts is original and interesting. The author does not, like most recent physiologists, view the logarithmic ratio of stimulus to sensation as a purely physiological relation, due to what Mr. James has recently called the friction of the nerve-machine, but connects it with a more general psycho-physical law formulated by Hering, viz. "that the purity, distinctness, or clearness of a sensation or idea depends on the relation in which the weight of the same, *i.e.* the magnitude of the corresponding psycho-physical process, stands to the collective weight of all simultaneously present sensations and ideas, *i.e.* to the sum of the magnitudes of all the corresponding psycho-physical processes." At the same time the author is far from clear when he speaks of the conscious comparison of intensities as an "associative activity." This is an example of a tendency among the younger physiological psychologists to force psychical processes into a physiological framework. Comparison cannot, as Münsterberg's ingenious but futile attempts plainly show, be regarded as *merely* an associative process, though of course it depends on association, and in this way can be correlated with a nervous process. It must, however, be said in justice to Dr. Ziehen, that he is commendably free from the common tendency of physiologists to ignore psychical distinctions. Thus it is quite refreshing to find a physiologist contending that black and grey are positive sensations, having each its distinctive quality, like white or blue. It may be added that special interest is given to the exposition of sensation, as of the other psychical phenomena, by the frequent bringing in of the biological point of view, and the suggestion how, by the process of natural selection, particular psycho-physical arrangements have been brought about and rendered permanent.

The account of sensation is supplemented by a chapter on the affective or emotional tone of sensations, *i.e.* their pleasurable or painful aspect. Here, again, we have frequent references to the Darwinian theory, as when it is suggested, *à propos* of the fact that extreme intensities of skin-sensation, pressure, heat and cold, lose their distinctive sensational quality, and become purely affective phenomena or pains, that this arrangement has come about owing to the circumstance that in the evolution of the zoological series "intensive mechanical and caloric stimuli constitute the earliest, the most frequent, the most direct, and the greatest danger to the animal organism" (p. 85). The author refers the whole of the difference in affective tone among colours, and among combinations of musical sound, to association. This seems to be going too far. The contrast between the exhilarating effect of the warm colours, and the quiet effect of those at the violet end of the spectrum, seems to be connected in part with the difference in the underlying nervous processes; and this is certainly true, as Helmholtz has shown, with respect to the emotional aspect of certain accords, *e.g.* the major and minor triads.

Coming now to the account of the idea (image and concept), we note that Dr. Ziehen differs from the majority of contemporary psychologists in assigning a separate cortical element to the sensation and to the idea. These different cells (the author, in spite of Lewes's attacks on the cell-superstition, talks of the individual cell as the seat of a sensation) are closely connected, and in this way the after-effect of sensations in memory, as also the reflex effects of ideas in exciting sensations, as in hallucinations, are accounted for. The writer elaborates his peculiar anatomical hypothesis in an ingenious way. He seems to admit, however, that it is a pure hypothesis, for the facts of "mental blindness" referred to are not apparently put forward as a proof; and it may be added that rightly viewed they do not seem even to suggest the hypothesis. One may add that it appears to lack the only possible justification of such a hypothesis, viz. that it simplifies the interpretation of the facts. The other supposition, that the sensation and the idea involve the same group of central elements (not the same single cell), is more reasonable in itself, and seems to offer a readier explanation of most of the phenomena.

The account of the psycho-physical process in association is less clear and instructive than most of the exposition. The author follows Münsterberg a good way at least—in reducing all association to one form, viz. contiguous, and more particularly simultaneous, association. But the diagrammatic representation of the processes strikes one as needlessly complicated by the hypothesis of separate ideational nerve-cells. Much better is the account at the close of this lecture of the way in which the different psycho-physical factors co-operate and modify one another in the actual concrete processes of reproduction. Dr. Ziehen is particularly happy in explaining the great variability of the sequences of our ideas from moment to moment. The account of the ideational stage is completed by a discussion of the relation of association to judgment and reasoning—which is a little hasty, and ignores some of the main difficulties of the subject, of attention and the voluntary control of the thought-process, and of the abnormal modifications of ideation in mental disease, sleep, and hypnosis.

The unfolding of the third and final stage, voluntary action, with which the volume concludes, offers little that is noteworthy. The author adopts the new and growingly fashionable view that all our active consciousness, sense of muscular effort, and so forth, is the result of afferent nerve processes, and he proceeds, much in the manner of Münsterberg, to resolve all volitional processes into complexes of sensations and ideas, more particularly ideas of movement. This seems to lead logically to the denial of any distinctive active or volitional psychosis answering to ideational or emotional psychosis; and Dr. Ziehen is not afraid to express this denial, and fortifies his position by the debatable statement that psychiatry, while acknowledging a special variety of intellectual and of emotional disturbance, knows no such thing as a distinct volitionary disturbance. It is to be added that the exposition concludes with a particularly good discussion of the final results of psycho-physical research. The author here shows himself a genuine psychologist, and while insisting upon the invariable concomitance of a physiological factor in psychical phenomena, is so far from regarding the psychical as a non-essential and negligible accompaniment of the material process, that he closes in a quite Kantian strain by reminding us that the psychical chain is that which is known primarily and immediately, and which as such must always possess more reality for us. J. S.

ACHIEVEMENTS IN ENGINEERING.

Achievements in Engineering. By L. F. Vernon-Harcourt, M.Inst.C.E. (London: Seeley and Co., Limited, 1891.)

THE object of this book is to describe some of the principal engineering works carried out during the last fifty years at home and abroad. The author has avoided technical phraseology to a great extent, thus making a very interesting subject as clear as may be to the general reader. Much subject-matter has been gleaned from many sources, and these are amply enumerated in the preface.

The London Metropolitan Railways and the New York elevated railways are described in chapter i. The growth of the Metropolitan system is very interesting, and is traced from the opening of the first section from Paddington to Farringdon Street in 1863 to the completion of the "Inner Circle" from the Mansion House to Aldgate in 1884. The author states that when the Metropolitan Railway was first designed, it was intended that the traffic should be worked by smokeless, hot-water locomotives not burning fuel, as it was supposed that the trains would be small, and that "foreign" locomotives would not travel over the line to any important extent. This, however, was not carried out, and locomotives of the ordinary type were adopted. The ventilation therefore proved defective, and even to this day improvement is greatly needed in many sections. The bad atmosphere is, of course, due to the locomotives in use, and the emission of steam considerably adds to the nuisance. Locomotive engineering is surely able to cope with this trouble. The dead weight of the trains might be considerably reduced with advantage, and the engines designed with ample condensing arrangements, even if the latter had to be attached to the engine as a separate vehicle. The boilers should, of course, be large enough to steam well with the ordinary blower, so that all the exhaust might be condensed.

The Metropolitan Railway represents an engineering achievement novel in many respects and made under circumstances of peculiar difficulty. On the other hand, the New York elevated railways illustrate how the American engineers solved a similar problem in a very different manner. Owing to the cost of "burrowing underground," as the author aptly describes it, they rejected the underground scheme, and for the same reason a railway on an arched viaduct was also considered undesirable. The railways have been carried along the streets, raised above the street traffic on girders resting upon wrought iron lattice columns standing at convenient places on the line of the curb of the pavements. An illustration is given representing a street in New York and the elevated railways running on each side. No payment has been made for placing these columns along the streets, and no compensation has been paid for damages to residential property fronting the railways. The author estimates the depreciation in value, due to the presence of the railway, as not less than 50 per cent. The cost per mile will therefore be considerably less than in the case of the London Metropolitan Railway, in which case all these items were heavily paid for. The London railway cost about £575,000 per mile, whereas the New York elevated railways only cost about £81,000 per mile.

Chapter ii. describes railways across the Alps, the Rocky Mountains, and the Andes. On p. 30 we find an interesting diagram representing the gradients and altitudes of the heavy portions of these lines, from which it is evident that the lines in North and South America are at higher elevations and are more subject to snow than the highest of the Alpine railways, and more severe gradients are to be found. Take, for instance, the heavy gradient on the Mexican Railway, rising 6400 feet in 54 miles, the maximum gradient being 1 in 25. This portion of the line is worked by Fairlie engines, which the author attempts to describe on p. 56.

The author in describing the Festiniog Railway says that the traffic is worked up the long incline by "duplex bogie engines, introduced in 1869, having two engines, united by a tender common to the two, and hinged at the centre." He goes on to say that these are called Fairlie engines, after the name of their designer. The Fairlie engines as used on the Mexican Railway certainly do not agree with this description, nor does this description agree with the usually accepted type of engine known as the "Fairlie." The Fairlie engine consists of a special type of boiler carried on bogies, one at each end. These bogies have either four or six wheels, as the case may be; each bogie is fitted with steam cylinders and gear complete, and all the wheels are coupled. The boiler has a smokebox at each end, and is fitted with fire-boxes in the centre, being fired from the side. The steam pipes from the boiler to the "steam" bogies are flexible, to allow the